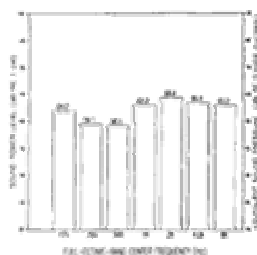


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1.0 Purpose/Scope

This procedure provides a standardized method for the calibration and operation of the GenRad GR1982 as an Octave Band Analyzer (OBA). It should be used in conjunction with the SBMS Subject Area *Noise and Hearing Conservation* and IH SOP IH96200 *Noise Measurement Principles: Area Surveys*.

The GenRad 1982, when used as an OBA, is used to determine the sound pressure level at octave bands from 31Hz to 16kHz to evaluate problem-noise sources and measuring the effectiveness of engineering controls.

2.0 Responsibilities

- 2.1 Use of the GenRad 1982 shall be limited to persons who act under the direction of a competent hazard assessment person and have demonstrated the competency to satisfactorily use the meter, as evidenced by experience and training, to the satisfaction of their supervision or existing qualification criteria set by their organization.
- 2.2 Personnel that perform exposure monitoring with this instrument are responsible to follow all steps in this procedure.

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- 2.3 The data collected using this meter must have an appropriate evaluation of the hazard and risk by a skilled Industrial Hygiene professional.

3.0 **Definitions**

- 3.1 *Decibel (dB)*: A non-dimensional unit used to express sound pressure levels. It is the log of the ratio of the measured sound pressure level to a reference level.
- 3.1.1 *dBA*: A sound pressure level in decibels made on the A-scale of a sound level meter. This unit of measure approximates the response of the human ear.
- 3.1.2 *dB(C)*: Sound pressure based on a nearly flat, non-weighted scale.
- 3.2 *Frequency*: The number of cycles completed by a periodic quantity in a unit time. Unit, hertz (Hz) measures cycles per second.
- 3.3 *Impulse or Impact Noise Levels*: Variations in noise levels that involve peak levels spaced at periods of greater than one per second. Where the intervals are less than one second, it should be considered a continuous noise source.
- 3.4 *Occupational Exposure Limit*: The maximum time weighted average (TWA) exposure permitted for employee exposure, based on the less of the OSHA Permissible Exposure Limits (PEL) or ACGIH Threshold Limit Value (TLV). See IH96200.

4.0 **Prerequisites**

4.1 **Training prior to using this meter:**

- 4.1.1 Demonstration of proper operation of the instrument to the satisfaction of the employee's supervision. Refer to Section 7 *Implementation and Training*.
- 4.1.2 Other appropriate training for other hazards in the area to be entered may be needed. Check with ESH coordinator or FS Representative for the facility.
- 4.1.3 Noise and Hearing Conservation Training and a Baseline audiogram may be needed if the duration of exposure to the person performing the survey will be in excess of the OSHA Permissible Exposure Limits (PEL) or ACGIH Threshold Limit Value (TLV) (which ever is less). See IH96200.

4.2 **Area Access:**

- 4.2.1 Contact the appropriate Facility Support Representative or Technician to obtain approval to enter radiological areas.
- 4.2.2 Verify with the appropriate Facility Support Representative or Technician if a Work Permit or Radiological Permit is needed or is in effect. If so, review and

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- sign the permit.
- 4.2.3 Use appropriate PPE for area

5.0 Precautions

5.1 Hazard Determination:

- 5.1.1 The operation of this meter does not cause exposure to any chemical, physical, or radiological hazards. The meter design does not cause significant ergonomic concerns in routine use. The meter does not generate Hazardous Waste.
- 5.1.2 By its very nature, the GenRad meter may be used in areas where excessive noise levels exist or are suspected to be present. Exposures to noise levels above the PEL and/or TLV may cause temporary or permanent hearing loss.

5.2 Personal Protective Equipment:

- 5.2.1 In areas where noise levels exceed the *Occupational Exposure Limit (OEL)*, hearing protection should be worn. The hearing protection should be able to reduce the noise levels below the OEL. See IH96200 for guidance on PPE selection.
- 5.2.2 Additional PPE: Other appropriate PPE for the area being entered. Check with your ES&H representative.

6.0 Procedure

Equipment: (Pictured in Appendix 9.1)

- Meter Body
- Microphone
- Calibration screwdriver
- Calibrator

Operation of the GenRad (picture of meter and description of controls and displays is contained in Appendix 9.1.)

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6.1 Battery Check

- 6.1.1 Slide the Power switch to the *BAT* and hold it there briefly.
- 6.1.2 Verify that the meter pointer indicates in the *BAT ok* areas and that the digital display indicates *888.8*. If it does not, recharge battery.
- 6.1.3 Perform the battery check at least once every half hour of use.

6.2 Warm-up: A warm-up is not required for this meter.

6.3 Calibration:

- 6.3.1 Verify that the calibrator battery checks ok.
- 6.3.2 Slide the *Power Switch* to *ON* and the *DIGITAL DISPLAY* switch to *CONT*.
- 6.3.3 Set the *Octave Filter* switch to *WTG*, the *WEIGHTING* switch to *A*, and the *Detector* switch to *SLOW*. Select the *70 to 120 dB* range.
- 6.3.4 Turn the calibrator on.
- 6.3.5 Place the calibrator, with ½ inch coupler/adaptor installed, over the microphone of the sound level meter (SLM).
- 6.3.6 Observe that both the SLM pointer and the digital display indicate *114* (plus or minus 0.5 dB). Check the meter response at each frequency band. Record reading on both the dBA and dBC weighting scales and each frequency. If the indication is outside this range, adjust the *CAL* control.

6.4 Operation:

- 6.4.1 Select the desired weighting by sliding the *WEIGHTING* switch to *A*, *B*, *C* or *FLAT*.
- 6.4.2 Move the *OCTAVE FILTER* switch to each frequency band and record the meter reading on the data form. Also test the noise level with the meter in the *WTG* position.
- 6.4.3 Select desired detector characteristic by sliding the *DETECTOR* switch to *FAST*, *IMP*, *PEAK*, or *SLOW*. The detector can be reset in either the *IMP* or *PEAK* modes by depressing the *CAPTURE* button momentarily.
- 6.4.4 Adjust the *dB RANGE* switch for an on-scale meter indication and read the meter or digital display. If the *OVERLOAD* lamp is lit, adjust the *dB RANGE* switch to a higher range.

6.5 Digital Display:

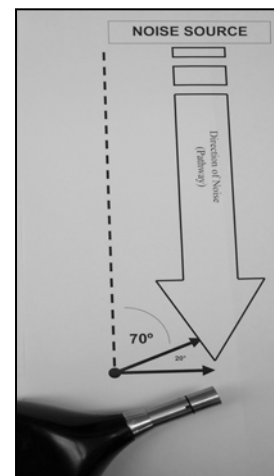
- 6.5.1 For a display that duplicates the meter indication, set the *DIGITAL DISPLAY* switch to *CONT*. The display will now track the meter indication.

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- 6.5.2 To capture a measurement, slide the *DIGITAL DISPLAY* switch to *CONT* and at the desired moment, press and hold the *CAPTURE* button. The digital display will be “frozen” as long as the *CAPTURE* button is held.
- 6.5.3 To capture the maximum indication during a measurement period, slide the *DIGITAL DISPLAY* switch to *MAX*. Press the *CAPTURE* button and release it to begin the measurement period.

6.6 Operator Position: Preferably the operator should be further from the sound source than the microphone and positioned as to reduce reflection of the sound to the meter. Hold the meter at arms length.

- 6.6.1 DO NOT stand between the sound source and microphone.
- 6.6.2 DO NOT place the hand within 12 cm (5 inches) of the microphone.
- 6.6.3 The microphone is a “flat-random-incidence-response type”. Do not point the meter at the source, hold it at a 70-90 degree angle, i.e., take the measurement so that the path from the noise source to the microphone is along a 70° to 90°.)
- 6.6.4 Take measurements at ear level of employee (sitting, standing or bending) to estimate personal exposures and to locate isometric lines of noise intensity on a sketch for defining area levels.
- 6.6.5 Perform a post calibration as per step 6.3.



6.7 Recording readings:

- 6.7.1 Use the BNL Direct Reading Sampling Instrument Form to record readings (see the IH web page for the most recent version).
- 6.7.2 Return meter and original sampling form to the SHSD IH Laboratory daily or at the end of each project as agreed to by the IH Laboratory Technician.
- 6.7.3 Send a copy of any hazard evaluation report written on the survey to the IH Laboratory and the Occupational Medicine Clinic.

7.0 Implementation and Training

7.1 Training prior to using this meter:

- 7.1.1 Demonstration of proper operation of the instrument to the satisfaction of the employee's supervision.

The only official copy is on-line at the SHSD IH Group website.
Before using a printed copy, verify that it is current by checking the document issue date on the website.

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- 7.2 SHSD IH Group personnel document their training using the SOP IH96120 Attachment 9.2 with its *Job Performance Measure Completion Certificate: IH Group Member NHC Hazard Assessor*.

8.0 References

- 8.1 **GenRad GR 1982 Precision Sound-Level Meter and Analyzer Instruction Manual.**
- 8.2 **BNL SBMS Subject Area *Noise and Hearing Conservation*.**
- 8.3 **OSHA Noise/Hearing Conservation 29CFR1910.95.**
- 8.4 **NIOSH Criteria for a Recommended Standard-Occupational Noise Exposure, 1998.**
- 8.5 **ACGIH American Conference of Governmental Industrial Hygienists Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices.**

9.0 Attachments

- 9.1 **Photo of meter and parts**
- 9.2 **Theory of Operation**
- 9.3 **Short List of Operating Instructions**
- 9.4 **Octave Band Analysis: Area Survey Form**

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10.0 Documentation

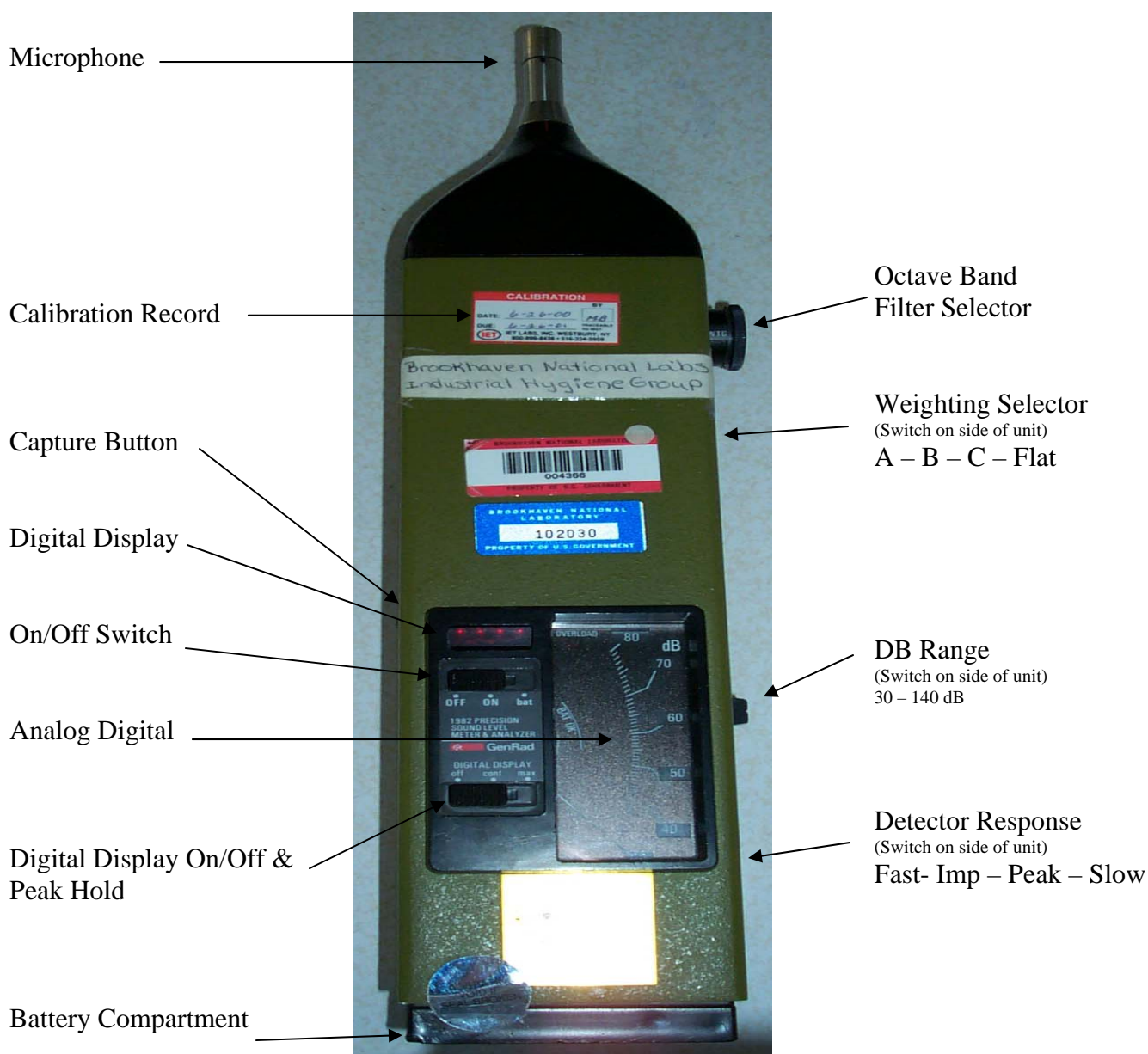
Document Review Tracking Sheet		
PREPARED BY: <i>(Signature and date on file)</i> R. Selvey Author Date 03/14/01	REVIEWED BY: <i>(Signature and date on file)</i> J. Peters SHSD IH Group Date 03/15/01	APPROVED BY: <i>(Signature and date on file)</i> R. Selvey SHSD IH Group Leader Date 03/15/01
Filing Code: IH51SR.01	DQAR Date	Effective Date: 06/08/01

Periodic Review Record		
Date of Review	Reviewer Signature and Date	Comments Attached
12/30/03	Robert Selvey/ J. Peters	Corrected error in Section 6.2.3.6
04/12/04	<i>(Signature and date on file)</i> R. Selvey	Revised format with Section 7 as Implementation and Training. Updated references to SBMS. Updated reference to JPM in IH96120.

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Attachment 9.1

Photo of the Meter and Parts



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Attachment 9.2

Theory of Operation

The GenRad GR 1982 is a precision sound level meter which incorporates octave-band filters from 31.5 Hz to 16 kHz, A, B, C and Flat weighting networks, as well as FAST, SLOW, IMPACT and IMPULSE detector response. The sound pressure is displayed on a 50-dB linear scale. The meter utilizes a 4-digit display that follows the analog meter indication with a 0.1 dB resolution.

- A reading can be captured on the digital display at the precise instant required while the analog meter continues to track the incoming noise level
- The digital display can be used in the continuous mode or it can be operated to capture and hold the maximum level encountered. This is extremely useful when measuring sounds of short duration or vehicle “passerby” sounds.
- In the maximum mode, the digital display will be updated by the highest sound level. The display can be reset by pressing a button.
- In the peak (impact) or impulse modes, the peak detector can be reset by the press of a button. This allows other readings to be taken without waiting for the peak detector to decay.

Weighting Networks. The meter contains three weighting networks, A, B, C, which shape the noise to discriminate against the frequency components of the measured noise.

- *A Network*: Simulates subjective responses to noise. Generally used in noise surveys to locate noise hazards. The A Network discriminates the low frequencies quite severely. Most regulations require that noise be measured on the A-weighting scale.
- *B Network*: Moderately discriminates (filters) against low frequencies
- *C Network*: Barely discriminates (filters) against low frequencies.

If measured sound levels of noise are much higher on the C-weighting than on the A-weighting, much of the noise is contributed by the low frequencies.

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Attachment 9.3

Short Operating Instructions

	Step	User Action	Digital Display
1	Battery Check	Slide power switch to battery – hold briefly. Pointer should indicate <i>BAT ok</i>	§§§§.§
2	Pre-Calibration	Power switch ON Octave Filter switch – WTG Weighting Switch to A Detector Switch to SLOW Turn Calibrator on and place over microphone of meter (using installed ½ inch coupler/adaptor). Record meter reading at each frequency from 31 Hz to 16kHz.	<i>CONT</i> Select 70-120 dB range: meter reading of <i>114</i> (plus or minus 5 dB) is acceptable.
3	Operator Position	Stand at the same distance from sound source as the microphone. Hold Meter at arms length.	
4	Operation	Select Weighting Switch to A, B, C or FLAT Select Detector Switch to FAST, IMP, PEAK or Slow Adjust dB range to keep meter on scale Record meter reading at each frequency from 31 Hz to 16kHz.	
5	Capturing Measurement	Slide Digital Display Switch to CONT and press CAPTURE button. To capture maximum dB level during measurement, slide Digital Display Switch to MAX and Press CAPTURE button.	
6	Post Calibration	Repeat Step 2.	

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Attachment 9.4

Octave Band Analysis Area Survey Form

(next page)

(form is two sided)

BROOKHAVEN NATIONAL LABORATORY Environment, Safety, Health and Quality Directorate		OCTAVE BAND ANALYSIS NOISE MEASUREMENT FORM
DATE:	SURVEYOR(S):	

I. AREA INFORMATION		
DEPT:	BLDG:	ROOM:
SOURCE:		
ENGINEERING CONTROLS:		

II. EMPLOYEE INFORMATION		
FIRST NAME:	LAST NAME:	BNL #:
DEPT:	BLDG:	JOB TITLE:
EXPOSURE DURATION (HRS):	EXPOSURE (TIMES PER DAY):	EXPOSURE (DAYS PER YR):
JOB PERFORMED:		
PPE USED:		

III. SURVEY INSTRUMENT INFORMATION												
INSTRUMENT:	MODEL:						SERIAL#:					
FACTORY CALIBRATION DATE:	PRE-CAL: BY:						POST CAL: BY:					
BATTERY CHECK (Y/N):	125 250 500 1000 2000						125 250 500 1000 2000					
CALIBRATOR SERIAL #:	dBA						dBA					
	dBC						dBC					

IV. SAMPLING INFORMATION & RESULTS											
Response: <input type="checkbox"/> FAST <input type="checkbox"/> SLOW <input type="checkbox"/> PEAK <input type="checkbox"/> IMPULSE Weighting: <input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> Flat WIND SCREEN: Y N											
LOCATION OF SAMPLE	WGT	31	62	125	250	500	1000	2000	4000	8000	16000
_____ Additional Data on page 2											

V. CONCLUSIONS & RECOMMENDATIONS	
Return completed form to: IH Lab, Building 129A	
FILE CODE: IH69SR. FORM IH96301 (03/01)	

IV. SAMPLING INFORMATION & RESULTS											
LOCATION OF SAMPLE	WGT	31	62	125	250	500	1000	2000	4000	8000	16000

8SKETCH OF SAMPLING AREA (OPTIONAL)

